

size, but principally through a prolonged connexion with the Indian continent.

Of those islands east of the boundary-line, Celebes was first cut off from the Indian mainland, and from that time has so remained. Hence it retained isolated ancient forms, which developed independently. Since it consisted from an early date of separate small islands, the fauna remained poor.

As regards the southern chain of islands (Bali, Lombok, Sumbawa, Flores, Timor, &c.), the impoverishment of the Indian fauna begins even in Bali. A sharp boundary between Bali and Lombok, which would have to rest on the evidence of various groups of animals, does not exist. Marsupials appear first in Timor, represented by one species of *Phalanger*. The above-mentioned southern chain of islands is therefore a zoogeographical representative of an earlier Java. To compare this chain with Celebes alone is inadmissible on account of the difference in their ages.

East of Celebes and Flores we come for the first time into a distinct transition region, where the Indian forms gradually retire and the Australian increase in number the further eastwards we go.

XVII.—*A Re-examination of Hutton's Types of New Zealand Earthworms.* By W. BLAXLAND BENHAM, D.Sc., M.A., Professor of Biology, University of Otago, Dunedin, New Zealand.

CAPTAIN HUTTON'S account of New Zealand earthworms was written some twenty years ago*, when the study of earthworms was only just engaging the attention of Perrier, and at a time when even the specific characters of the common British earthworms were absolutely neglected by English zoologists, in spite of the careful accounts by Dugès, at a time when there was practically no literature dealing with exotic genera except the papers which are buried in periodicals which were to be found only in the larger libraries; it is not surprising, therefore, that the descriptions should be vague, imperfect, and almost useless. Those of us who have made a study of earthworms have long recognized that Hutton's genera, in which he places the species, are

* "On the New Zealand Earthworms in the Otago Museum," Trans. New Zealand Institute, vol. ix. 1876, p. 350.

incorrect; and since Beddard's series of papers upon the New Zealand worms it has become a certainty that most of Hutton's species belong in all probability to *Acanthodrilid* genera.

Consequently, soon after my arrival in Dunedin, I took the opportunity of examining the "types," which I discovered in a storeroom in the Otago Museum.

Hutton described six species, of which he placed four in the genus *Lumbricus* and two in *Megascolex*. In a subsequent paper* he suggested that *L. uliginosus* belongs to *Acanthodrilus*, and some of the species of the former genus were probably members of the genus "*Digaster*," though upon what ground it is difficult to say. As will be seen from the following account, Hutton has sometimes confused two or more distinct worms under one name. I append a list of his species, so far as it is possible to identify them, and then give some details as to the individuals:—

(1) *Acanthodrilus uliginosus*, Hutton.

Syn. *Lumbricus uliginosus*, Hutton.

(2) *Neodrilus monocystis*, Beddard.

Syn. *Lumbricus campestris*, Hutton, partim.

(3) *Lumbricus rubellus*, Hoffmeister.

Syn. *Lumbricus campestris*, Hutton, partim.

(4) *Allolobophora caliginosa*, Savigny.

Syn. *Lumbricus levis*, Hutton, partim.

(5) *Octochætus* (?) *levis*, Hutton.

Syn. *Lumbricus levis*, Hutton, partim.

(6) *Allolobophora fætida*, Savigny.

Syn. *Lumbricus annulatus*, Hutton.

(7) *Plagiochata sylvestris*, Hutton.

Syn. *Megascolex sylvestris*, Hutton.

(8) *Plagiochata lineata*, Hutton.

Syn. *Megascolex lineatus*, Hutton.

(1) Of the six "types" I have been able to examine in detail only five; but I cannot discover the original of "*Lumb.*"

* 'New Zealand Journal of Science,' i. 1883, p. 585, note.

uliginosus." Nevertheless it is evident that it is an *Acanthodrilus*, but impossible to say whether it belongs to any species more recently and more carefully described; it seems best in such a case to leave the matter alone, and to regard it as a distinct species.

(2) "*L. campestris*."—There are three bottles so labelled, which I will indicate by the letters *a*, *b*, *c*.

(a) Contains two individuals collected in Dunedin; they are well-preserved mature worms, which are at once recognizable as belonging to that curious Acanthodrilid which Beddard * termed *Neodrilus*, a genus which he now refuses to recognize as distinct from *Acanthodrilus* †. It seems to me that the characters of *N. monocystis* are every bit as distinctive and important as those upon which he founds the genus *Octochaetus*. At any rate, Hutton's worm is characterized by the single spermiducal gland, the single spermatheca, and other features, a detailed account of which was published by me in 1892 ‡. The worm is common around Dunedin, and, as a matter of fact, the very first earthworm I picked up in the bush round the town was *N. monocystis*, from which Hutton's type does not differ.

As will be seen below, it is impossible to retain Hutton's specific name, since he has confused under it two distinct worms.

(b) Labelled "Water of Leith," contained a single individual and a portion of a worm, which are also *Neodrilus*.

(c) Labelled "Wellington," contains three individuals, all of which agree one with another in external characters, viz. the prostomium reaches to the first intersegmental groove, and is traversed by an indistinct transverse furrow; the clitellum covers the segments 27 to 32, while the twenty-sixth exhibits some glandular modifications; the tubercula pubertates are on the segments 28 to 31; the first dorsal pore is between the segments 6/7. With the exception of the last feature, and in the fact that the worms are slightly smaller than usual (viz. $1\frac{1}{2}$ to 2 inches), these specimens agree with the descriptions of *Lumbricus rubellus*.

A reference to Hutton's description shows that he had both *Neodrilus* and *Lumbricus* before him, as he says "Colour

* Beddard, "Observations on the Structural Characters of certain new or little-known Earthworms," Proc. Roy. Soc. Edinb. 1887, vol. xiv. p. 157.

† 'Monograph of the Order Oligochaeta,' 1895.

‡ Benham, "Notes on Two Acanthodriloid Earthworms from New Zealand," Quart. Journ. Micr. Sci. vol. xxiii. p. 289.

reddish [as it is in the latter] or olivaceous green" [as in the former worm]. The position of the clitellum is said to be "irregular, commencing on any segment from 10 to 20," which is inaccurate whichever worm he referred to, though it is not so far out if *Neodrilus* was before him. Further, "the male genital pores [by which he means the spermathecal pores] are on the ninth segment" is true for *Neodrilus**, for in this worm these pores are fairly conspicuous, which is not the case in *Lumbricus*. The statement "vulvæ [*i. e.* the male pores and papillæ] on the two last segments of the clitellum" evidently refers to *Neodrilus*. His accounts of the chætæ and prostomium apply equally to either worm.

His statement that "the olivaceous specimens occur in the bush" is perfectly correct, whereas the red (*L. rubellus*) is common in the gardens round the towns.

(3) "*Lumbricus levis*."—Of this there were two bottles:—

(a) "Hampden," contains one individual measuring $1\frac{3}{8}$ inch in length, with spaced nearly equidistant chætæ on each side:—If a be the most ventral chæta, $a-b=c-d$; while $b-c$ is slightly greater than $a-b$; and $a-a=d-d=2a-b$.

The clitellum covers segments 14 to 19. The worm is not fully mature, and I am unable to recognize the male pores. Internally—for I dared to open the type—I note that the dorsal vessel is double throughout, as in some species of *Octochaetus*; there is a large gizzard in the sixth segment, and two pairs of spermathecae in segments 8 and 9, each with a single small rounded diverticulum lying in the same segment.

These are all the facts that I was able to be sure about, but they are sufficient to refer the worm with the greatest probability to the genus *Octochaetus*. It is smaller than any of Beddard's species.

(b) Labelled "Dunedin," contains also a single specimen measuring 4 inches, and is *Allolobophora caliginosa*, one of the commonest introduced species about the town.

Hutton's account of "*Lumbricus levis*" seems to have had reference to this individual, for he gives the length as "3 to 4 inches; pale flesh-colour. . . . Setæ feeble, in four rows behind the clitellum, absent before the clitellum." This last statement I cannot understand; moreover he represents them, correctly, on the anterior segments; yet he points out that in this particular the worm differs from *L. communis*, another name for *L. caliginosa*.

* In the method of enumeration now adopted we must subtract one from Hutton's numbers.

But his account of the clitellum as "commencing between the fifteenth and twenty-fifth segment" is evidently due to a comparison between the two worms, as are also the following sentences:—"Male genital openings on the tenth to the fifteenth segments" (*i. e.* spermathecae). "Vulvæ on the two last segments of the clitellum" may refer either to the male papillæ of *Octochatus* or to the tubercula of *Allolobophora*.

(4) "*Lumbricus annulatus*."—A bottle labelled thus contains four worms collected in Dunedin. Only one is mature and possesses a clitellum, but the three others, which are but imperfectly preserved, agree in regard to size and position of the dorsal pore. The worms are, indeed, nothing other than *Allolobophora fætida*, as Hutton himself suspected. I must correct his statement that the clitellum is "not tuberculated inferiorly," for the tubercles exist as a curved indistinct ridge on the segments usual in the species, viz. 28, 29, 30, and extend on to 31.

(5) "*Megascolex sylvestris*."—A single bottle of worms collected in Dunedin, in rotten wood in the bush, contains two entire individuals and two portions; all are very poorly preserved, but in sufficiently good condition to show that, as Beddard has surmised ('Monograph,' p. 522), the worm belongs to my genus *Plagiochæta*.

It differs from *P. punctata* in the following points—and possibly in others—though, of course, I was unable to make a thorough examination of the specimens:—(1) It is cylindrical, not depressed; this may be due to its soft condition. (2) The dorsal and ventral gaps in the chætal rings are equal, and measure twice the normal gap between the individual couples; whereas in *P. punctata* the dorsal gap is about four times the normal. (3) The prostomium, as Hutton figures, does not cut right through the first segment. (4) There are apparently only three pairs of sperm-sacs, that in the ninth segment not being visible. (5) The chætæ measure 0.19 millim., the ventralmost couple, in my sections, reaching 0.22 millim., while the smallest is 0.165 millim. (in *P. punctata* they measure 0.36 millim.).

(6) "*Megascolex lineatus*."—Collected under dead leaves at Queenstown. The bottle contains one entire individual and three broken ones; all are so poorly preserved that they scarcely withstood handling. The length of the entire specimen is only 1½ inch. Hutton's drawing of the pro-

stomium is incorrect in representing it as much too narrow ; it is more like that of the preceding species, but cuts through the first segment. The chætæ are *not* in a continuous circle, but are quite evidently arranged in couples as in *Plagiochæta*. The specimen must have been more deeply pigmented than *P. sylvestris*, for whilst that is now absolutely colourless, this is faint brown.

The following points seem to differentiate it from *P. punctata* :—(1) The dorsal gap is three times and the ventral gap twice the length of a normal gap. (2) The spermiducal glands open on distinct papillæ, and there is no such marked ridge round the ventral "area" in this region as occurs in *P. punctata* (this may possibly be due to imperfect preservation). (3) The spermatheca has *two* peculiar diverticula in place of a single cylindrical one ; of these, one is an oval pouch, the other is a three-lobed pouch with a narrow neck ; they both open close together into the duct of the main sac. (4) The chætæ measure 0·22 millim., and are stouter and more strongly curved internally than in *P. sylvestris*.

Both these species agree with *P. punctata* in having 13 couples of chætæ on each side, which are inserted between distinct and separated bundles of longitudinal muscles, of which there are 12 on each side ; these are visible in transverse sections even between the chætal rings. The most dorsal and most ventral couples of chætæ are separated from their fellows respectively by a broader bundle, which appears to vary in size in the three species.

The nephridiopores alternate in position from segment to segment more or less regularly, and, as in *P. punctata*, the ventral pore lies between the third and fourth bundle, the dorsal pore between the ninth and tenth bundle, counting from below, as I have figured in pl. xv. fig. 17 (*loc. cit.*).

Dunedin,
Aug. 11, 1898.

XVIII.—*Notes on the Family Hetrodidæ, with a List of the described Species.* By W. F. KIRBY, F.L.S., F.E.S., &c.

[Concluded from p. 102.]

Notes on various Genera and Species of the Family Hetrodidæ.

Genus HETRODES, Fisch.

Walker has described four species, allied to *H. pupus*, Linn., viz. *H. marginatus*, *productus*, *macrurus*, and *abbreviatus*.